REMARKS

All of the claims submitted for examination in this application have been rejected on two substantative grounds. Applicants have reviewed these grounds of rejection and respectfully submit that all of the claims currently in the application are patentable thereover.

The first substantive ground of rejection is directed to Claims 1-13. Claims 1-13 stand rejected, under 35 U.S.C. §103(a), as being unpatentable over U.S. Patent Application Publication No. US 2002/0052125 A1 to Shaffer, II et al. taken in view of U.S. Patent No. 6,121,130 to Chua et al. and U.S. Patent No. 5,908,510 to McCullough et al.

The principal Shaffer, II et al. application discloses a process for forming an etched, coated semiconductor device followed by removing impurities comprising disposing a low dielectric constant curable organic polymeric film, generally as a multi-layer film on an electrically-conductive surface of a semiconductor substrate device, curing the film layers and contacting the film layer with heat in a baking step, to remove impurities from the film and the device.

The Official Action admits that the claims of the present application differ from the Shaffer, II et al. disclosure by the requirement that the cured polymeric organic film be contacted with supercritical carbon dioxide. In view of this failing, the Official Action applies Chua et al. for its teaching of removing both residual solvent and polymerization by-products from a semiconductor substrate coated with a film by thermal steps and McCullough et al. for its disclosure of removing residue from semiconductor devices that may include both etched and patterned composites having both silicon and polymeric layers by contact with supercritical carbon dioxide, the contact generally being at a significantly elevated temperature.

Based on these disclosures, the Official Action concludes that it would have been obvious to one skilled in the art to have enhanced the Shaffer, II et al. process by contacting the cured and coated semiconductor device with supercritical carbon dioxide to more thoroughly and completely remove a variety of residual impurities from the device.

It is emphasized at the outset that the present invention represents a significant advance in the art in providing a method of removing impurities from a low dielectric constant organic polymeric film disposed on a semiconductor device. Up to the time of the present disclosure, removal of impurities and foreign materials from organic polymeric low dielectric films employed in semiconductor devices involved contact of the cured low dielectric films with deionized water or by exposure of the semiconductor device to elevated temperatures. Attention is directed to the specification, at Page 2, lines 12-21, wherein this disclosure is set forth.

It is indeed surprising that the Shaffer, II et al. disclosure does nothing more than illustrate one of these two prior art methods of removing impurities of foreign materials from cured low dielectric films. As stated in the Official Action, Shaffer, II et al. discloses a baking step to remove impurities from the film and the device. This method, as indicated in the specification of the present application, represents nothing more than the known prior art.

To supplement the inadequacy of the principal Shaffer, II et al. reference, the Official Action applies, as a secondary reference, Chua et al. for its reference of removing residual solvent and polymerization by-products from a semiconductor substrate coated with a film by thermal steps. As such, Chua et al. does not supplement the teaching of Shaffer, II et al. Indeed, the Official Action implicitly admits that Chua et al. adds nothing to the Shaffer, II et al. reference by its admission that Shaffer, II et al. requires further supplementation. Since Chua et al. is substantially redundant with the Shaffer, II et al. disclosure, it is apparent that the

combination of these references does not disclose or suggest the invention embodied in Claims 1-13. Each of Claims 1-13 requires that supercritical carbon dioxide contact the organic polymeric film.

In view of these facts, it is apparent that the teaching of the McCullough et al. reference is determinative. McCullough et al. describes a method of removing residue by contact with supercritical carbon dioxide. However, McCullough et al. does not disclose or suggest contact of supercritical carbon dioxide with a cured organic polymeric film as required by each of Claims 1-13. (Emphasis added). The process disclosed in McCullough et al. removes residue from an etched precision surface, such as a semiconductor, by exposing a precision surface containing residue to supercritical carbon dioxide to remove that residue from the precision surface. This disclosure is far removed from contact with a curable organic polymeric film, as required by all of the claims of the present application. As set forth in the specification, at Page 2, line 22 to Page 3, line 3, applicants submit that although the use of supercritical carbon dioxide in the processing of semiconductor devices is known in the art, for example, the removal of reactive ion etching (RIE) impurities in foreign materials, removal of foreign components from cured organic polymeric dielectric insulting films by contact with supercritical carbon dioxide is unknown. Indeed, this specification paragraph mentions the applied McCullough et al. disclosure. However, as indicated in the specification, McCullough et al. merely addresses the removal of halogenated etched residue from a RIE precision surface by contact with supercritical carbon dioxide. That teaching is far removed from contacting a low dielectric constant cured film surface with supercritical carbon dioxide to remove impurities therefrom.

The mere removal of debris from vias, openings and the like, provided on precision surfaces, such as a semiconductor device, is far removed from the removal of foreign substances

from a cured polymeric film. Indeed, the two processes share no similarities. In one case, debris is removed from openings that cannot be penetrated by traditional fluids. Although that in and of itself is clearly surprising when first disclosed, it bears no relation to the removal of foreign substances from a cured polymeric film. The only similarity between the two concepts is that the cured polymeric film is disposed on a precision surface. However, where the cured organic polyermic film is disposed is irrelevant to the concept that is embodied in the claims of the present application. In view of the clearly distinguished nature of the claimed process of the present application compared to that of McCullough et al. and in view of the prior art nature of the other two applied references, it is apparent that none of Claims 1-13 are made obvious by the combined teaching of Shaffer, II et al., Chua et al. and McCullough et al.

The second substantative ground of rejection is directed to Claims 14-17. Claims 14-17 stand rejected, under 35 U.S.C. §103(a), as being unpatentable over Shaffer, II et al. in view of Chua et al. taken in further view of McCullough et al. and in yet further view of U.S. Patent 6,346,484 to Cotte et al. and U.S. Patent No. 6,120,613 to Romack et al.

The Official Action provides no explanation of this ground of rejection. It is noted, however, that Claims 14-17 differ from Claims 1-13 insofar as the contact with supercritical carbon dioxide in these claims also requires contact also with at least one additional solvent.

Applicants need not address this ground of rejection, insofar as the basis for the imposition of this ground of rejection is unstated. However, applicants emphasize that the predicate for patentability of Claims 1-13, in view of the absence of any disclosure in the applied prior art of a teaching of contacting a cured polymeric organic film with supercritical carbon dioxide, predicates patentability of Claims 14-17 which also requires that contact albeit in the additional presence of an additional solvent.

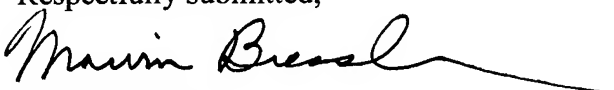
That the newly applied references of this second ground of rejection disclose the use of a solvent with supercritical carbon dioxide in processes remote from the process of Claims 14 to 17 does nothing to make obvious the process of these claims. That the invention of applying supercritical carbon dioxide alone in a process of removing impurities from a cured low dielectric constant is patentable only emphasizes the more remoteness of Claims 14-17 from the teachings of the prior art.

The above remarks establish the patentability of the claims of the present application over the two substantative grounds of rejection imposed in the outstanding Official Action. Reconsideration and removal of these grounds of rejection in view of these remarks is therefore deemed appropriate. Such action is respectfully urged.

Applicants submit that none of the cited but not applied references anticipate or make obvious any of the claims of the present application. Moreover, none of these references, when combined with each other or with any of the applied references, make obvious the claims of the present application.

The above remarks establish the patentable nature of all of the claims currently in this application. Notice of Allowance and passage to issue of these claims, Claims 1-17, is therefore respectfully solicited.

Respectfully submitted,



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